

SCIENCE AND TECHNOLOGY BENEFIT ANALYSIS

Idaho Operations Office – Idaho National Engineering and Environmental Laboratory
Bechtel BWXT Idaho LLC






INTEC 603 Basin Rack Scanner

The INTEC 603 spent fuel storage basins have been emptied of all identified fuel. As part of the next stage of decommissioning, the fuel storage racks and associated inaccessible spaces required a survey to determine that no fuel material remained. INEEL Spent Fuel Operations, in conjunction with the INEEL NDE Physics group developed a sodium iodide gamma ray spectrum assay head that, with shielding and collimation could fit into the 6" diameter rack ports and distinguish fuel material from the high background radiation present in the silt that remains in the racks and on the basin floor. 920 fuel storage ports were surveyed, and 440 side-looking inspections were made to verify that the space beneath the racks did not contain fuel material. Following a total of 1360 inspection scans, analysis of the data was performed, and the racks were released for removal.

Benefit: The safety of the rack removal operation is dependent on being sure that no fuel material is present prior to movement. The rack scanner ensured that nuclear criticality would not be a problem during rack removal.

Qualitative Benefit Analysis

Programmatic Risk	●	Completion of decommissioning of the fuel storage basins eliminates environmental risks. This tool provides information for appropriate management.
Technical Adequacy	●	Gamma spectrometry as used here allowed discrimination between fuel material and secondary fission product gamma ray background.
Safety	●	It is necessary to perform characterization of the basin racks to avoid moving the racks without knowing the risk that they represent.
Schedule Impact	●	Without this technology, the project of basin decommissioning would not have been able to proceed.

				
Major improvement	Some improvement	No change	Somewhat worse	Major Decline

Quantitative Benefit Analysis

Cost Impact Analysis

This is enabling technology that allowed resolution of material management concerns. It does not replace a prior alternative, and as such does not represent a comparative cost savings.

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Addendum to INTEC 603 Basin Rack Scanner

This technology deployment helped address needs ID-7.2.37: Fuel Pool Disposition Technologies, ID-7.2.20: Underwater Radionuclide Characterization of Structures, Equipment, and Containment Pool Walls that Produces Quantitative Data. and ID-7.2.06: Remote Characterization for Building Release, Large Area Surface Soil Characterization, and Characterization of Sumps, Debris, Underwater Areas, and Buried Pipes and Utilities.

ESTIMATE BASIS FOR: INTEC 603 Basin Rack Scanner

Worksheet 2: Itemized Project Funding Requirements* (i.e., One Time Implementation Costs)

Category	Cost \$
INITIAL CAPITAL INVESTMENT	
1. Design	\$ 505,000
2. Purchase	\$ 70,000
3. Installation	\$ -
4. Other Capital Investment (explain)	\$ 330,000
Subtotal: Capital Investment= (C)	\$ 905,000
INSTALLATION OPERATING EXPENSES	
1. Planning/Procedure Development	\$ 30,325
2. Training	\$ 16,000
3. Miscellaneous Supplies	\$ -
4. Startup/testing	\$ 57,000
5. Readiness Reviews/Management Assessment/Administrative Costs	\$ -
6. Other Installation Operating Expenses (explain)	\$ -
Subtotal: Installation Operating Expense = (E)	\$ 103,325
7. All company adders (G & A/PHMC Fee, MPR, GFS, Overhead, taxes, etc.)(if not contained in above items)	\$ -
Total Project Funding Requirements=(C + E)	\$ 1,008,325
Useful Project Life = (L) 1 Years Time to Implem 24 Months	
Estimated Project Termination/Disassembly Cost (if applicable) = (D)	\$ -
(Only for Projects where L<5 years; D=0 if L>5 years)	
TOTAL LIFE-CYCLE COST SAVINGS CALCULATION FOR IPABS-IS	
(Before - After) x (Useful Life) - (Total Project Funding Requirements + Termination)	
Total Life Cycle Cost Savings Estimate = (B - A) x L - (C+E+D)	
RETURN ON INVESTMENT CALCULATION	
Return on Investment (ROI) % =	
$\frac{(Before - After) - [(Total Project Funding Requirements + Termination)/Useful Life]}{[Total Project Funding Requirements + Project Termination]} \times 100$	
$ROI = \frac{B-A-[(C+E+D)/L]}{(C+E+D)} \times 100 - 100 \%$	
O&M Annual Recurring Costs:	Project Funding Requirements:
Annual Costs, Before= \$ - (B)	Capital Investment= \$ 905,000 (C)
Annual Costs, After= \$ - (A)	Installation Op. Exp= \$ 103,325 (E)
Net Annual Savings= \$ - (B-A)	Total Project Funds= \$ 1,008,325 (C+E)
Note: Before (B) and After (A) are Operating & Maintenance Annual Recurring Costs from Worksheet 1.	

* See attached Supporting Data and Calculations.

ESTIMATE BASIS FOR: INTEC 603 Basin Rack Scanner

GENERAL

INEEL Spent Fuel Operations, in conjunction with the INEEL NDE Physics group developed a sodium iodide gamma ray spectrum assay head that, with shielding and collimation could fit into the 6" diameter rack ports and distinguish fuel material from the high background radiation present in the silt that remains in the racks and on the basin floor. It was designed to identify any item containing as little as 0.5 gram of uranium-235 in an area of approximately 1 square foot at a height of one foot from the rack bottom so as to allow measurement of all rack port positions including an overlap to ensure that the entire rack area was surveyed. The sodium iodide detectors were custom made for this project by Canberra. All mounting, collimation and shielding hardware was designed and fabricated by INEEL NDE Physics and Prototype Engineering departments, and the data acquisition system was developed and adapted for this purpose by INEEL Physics personnel.

INITIAL CAPITAL INVESTMENT

The primary costs of design, procurement and fabrication amounted to approximately \$905,000.

INSTALLATION AND START-UP

Installation and startup costs amounted to \$103,000. These costs included significant procedure and training time as well as calibration and functional testing efforts. Readiness review costs are incorporated into this value as well.

ESTIMATE BASIS FOR: INTEC 603 Basin Rack Scanner

TRADITIONAL (BASELINE) TECHNOLOGY/METHOD

No baseline technology was identified for this issue. No spectrometer available would fit into the limited space of the rack ports, thus a specialized technology was developed.

NEW TECHNOLOGY/METHOD

INEEL Spent Fuel Operations, in conjunction with the INEEL NDE Physics group developed a sodium iodide gamma ray spectrum assay head that, with shielding and collimation could fit into the 6" diameter rack ports and distinguish fuel material from the high background radiation present in the silt that remains in the racks and on the basin floor. It was designed to identify any item containing as little as 0.5 gram of uranium-235 in an area of approximately 1 square foot at a height of one foot from the rack bottom so as to allow measurement of all rack port positions including an overlap to ensure that the entire rack area was surveyed. This determination is based on quantitation of cesium-137 and comparison of that value against a baseline fuel material of specific enrichment and burnup. The sodium iodide detectors were custom made for this project by Canberra. Alternate cadmium zinc telluride detectors can be used as necessary in areas of high radiation background. All mounting, collimation and shielding hardware was designed and fabricated by INEEL Physics and Prototype Engineering departments, and the data acquisition system was developed and adapted for this purpose by INEEL Physics personnel.

COST SAVINGS/COST AVOIDANCE/RISK REDUCTION

This is an enabling technology, and as such, no direct cost savings is calculated. Decommissioning of this facility with the potential of unidentified fissile material remaining could not be done.

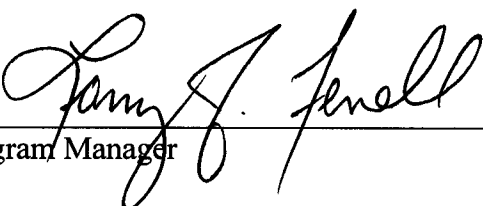
**SCIENCE AND TECHNOLOGY BENEFIT ANALYSIS
DEPLOYMENT APPROVALS**

Technology Deployed: INTEC 603 Basin Rack Scanner

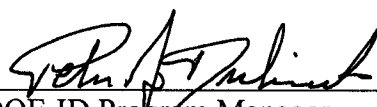
Date Deployed: FY-01

EM Program(s) Impacted: Spent Nuclear Fuel Program

Approval Signatures


Contractor Program Manager 8/9/01
Date

N/A
Contractor Program Manager Date


DOE-ID Program Manager 8/13/01
Date

N/A
DOE-ID Program Manager Date